II. Theoretical Basis

We obtain brain wave signals from the skin of the skull of the subjects who practice qigong. From the surface, the time series of this single variable can only provide rather limited information. Some people, in particular, will say that it is rather limited to use a "one dimensional" approach to the process of a system of numerous interwoven variables. In reality, this time series contains much richer information: it contains all the traces of all the variables of the dynamics involved; it makes it possible for people to confirm some important characteristics latent in a system, which have nothing to do with any model.

To analyze the turbidity of brain wave signals, one first must prove whether there are fragment attractors existing in brain waves. If there are no attractors, there will be no turbidity to talk about; secondly, one must solve for the dimension of the fragment attractors, d, when $d=1$, the system we process is the self-maintaining period oscillation; when $d=2$, we face two incompatible quasi-period oscillations; only when d is an incompatible quasi-period oscillation, and only when d is not an integer or is larger than 2 (fragment attractors, see section 2.10 in reference [3]), will the system indicate a sensitivity to the primary condition and possess unpredictable eigen turbidity oscillations.

1. The system to be proven

The question is whether or not brain wave signals contain attractors; all is needed is to draw its phase plot, with $X(t)$ as its horizontal axis, and $X(t+\tau)$ as its vertical axis, and see if its phase track can be restricted within a sub-set of a quadrant. If it is, there must be attractors in the system (and this sub-set is called a attractors).

2. The dimension of the attractor can be determined through the following steps

(1) Suppose our obtained brain wave time series is $XO(t)$, now introduce a vector Xi

$$Xi=(XO(ti),\ XO(tO+\tau),\ldots XO(ti+(n-1)\tau) \quad (i=1,2,\ldots,N) \tag{1}$$

In the formula, $\tau=m\Delta t$, m is a positive integer, and Δt is the sampling time.

(2) For different i's, solve for the distance between X_i and X_j, that is

$$r_{ij}=|\vec{X}_i-\vec{X}_j| \quad (i,j=1,2,\cdots,N,\ j\neq i) \tag{2}$$

(3) For r of different values (the value of r is a rather small positive integer), solve for $C(r)$

$$C(r)=\frac{1}{N^2}\sum_{\substack{i=1\\ j\neq i}}^{N}\theta(r-r_{ij}) \tag{3}$$

In the formula, $\theta(X)$ is Heaviside function, that is

$$\theta(X)=\begin{cases}1(X>0)\\ 0(X<0)\end{cases} \tag{4}$$

[illegible] standard to measure the distribution of X_i. The measurement of the non-zero $C(r)$ affects the degree of distribution of other points because of the existence of X_i. Therefore, $C(r)$ can be considered as the attractor's integral correlation function.

(4) In calculating the dimension d[4] of the attractor, because

$$C(r)\propto r^{d} \tag{5}$$

therefore

$$d=\ln C(r)/\ln r \tag{6}$$

The d here is the dimension of the attractor.

III. The Steps in the Experiment

We let the subjects sit quietly in a screened room, put four electrodes on their heads; the measured brain wave signals are sent out through cables from the screened room into an eight-track electroencephalogram (EEG); after noise filter and magnification, it is sent to a four-track tape recorder and the signals are recorded on the recorder.

During the analysis process, the brain wave signals are retrieved from the tape; after IBMPC sampling, the original data is sent through network into a VAX-II mini-computer to go through a series of processing and analysis steps.

IV. Results of Analysis

1. Proof of the existence of attractors

Following the method explained in Section II, we plot phase trace diagrams of the subjects' brain waves. The diagrams show that their phase trace stabilizes within a certain area, which is a sub-set of a quadrant; therefore, attractors do exist. This conclusion is consistent with the study[7] on brain wave attractors of the sleep phase, done by A. Babloyantz and others; the shapes of the diagrams are more or less similar (see Fig. 2); in Fig. 1, τ=10; the sampling frequency is 100Hz, total time is 20 seconds, and the differentiating frequency is 10bit. (Insert Figs 1 and 2)

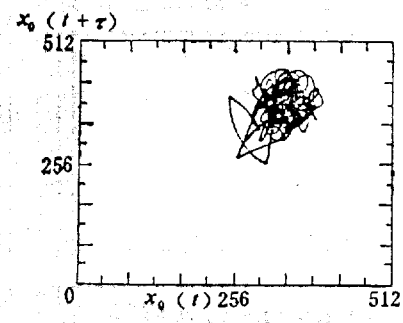
2. The dimensions of attractors

Fig. 3 plots the curves of $\ln C(r)$ and $\ln r$ at various times, n. The slope of the curve in the diagram is the dimension d of the attractors; the diagram shows when $n \geq 6$, slope d is unchanged. This is the first saturation value d, which is the dimension of the attractor for the corresponding brain wave signal system; here $d = 2.10$.

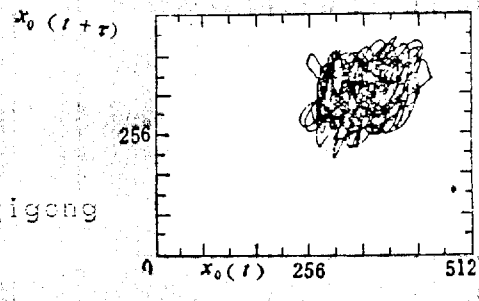
Fig. 4 shows the curves of d and n; Table 1 gives their actual values.

Following this method, we analyzed four cases; their situations are basically the same, but the d value is different. The result is shown in Table 2.

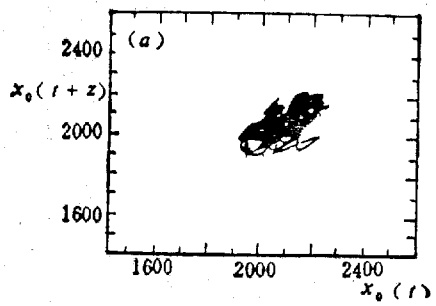
Fig. 1 Two dimensional diagrams of the subjects. f_s=100Hz; τ=10 , N=1000 total 10s. Plotted on VAX-II.



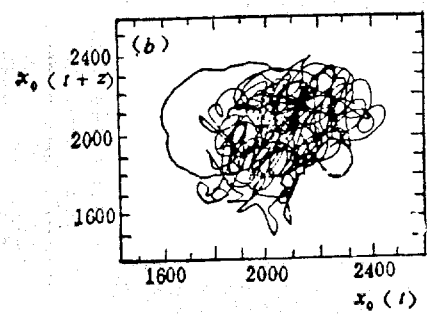
(a) The phase plot for before qigong.



(b) The phase plot for 10 minutes into qigong



(a) The awake phase



(b) The fourth stage of the sleep phase.

Fig. 2 Two dimensional Figure of the sleep phase plotted on EEG. f=100Hz, r=10Δt, N=4000 total 40s. Plotted on PDP 11-44.

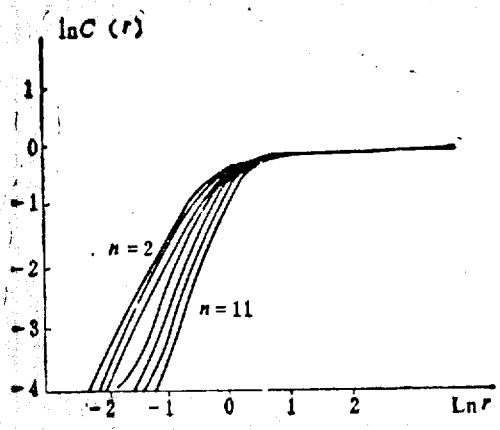


Fig. 3 The curve relation of lnC(r) and lnr to the various time, r.
f=100Hz, N=2000, N=500, Plotted on VAX-II

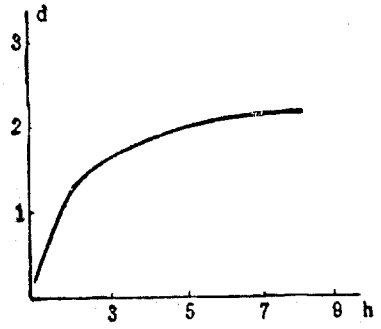


Fig. 4 The curve relation between d and n

Table 1 The relation between d and n

N	D
2	1.217
3	1.614
4	1.783
5	1.946
6	2.103
7	2.137
8	2.161

Table 2 The subject and the d value

Subjects (by number)	d value
No.1	2.10±0.10
No.2	1.51±0.10
No.3	1.17±0.10
No.4	2.24±0.10

V. Conclusion

The above analysis shows that for the subjects, their brain wave signals appear turbid (i.e. there are fragment attractors);

but the distribution of the dimension d value of their attractors is wide, see Table 2. On the other hand, the d value of the dimension of the attractors, which we obtained from the head of the subjects (d value is approximately between 2 and 3), differs greatly from other people's[7][8] results, which are for the awake phase (d=5 approximately) and the sleep phase (d=4 approximately). Perhaps the value difference can be used to measure the difference in the qigong skills of the subjects. But this is only an assumption; specific effort to prove it must be carried out.

References

[1] Zun Fuli and others, Journal of Psychology, 4th issue, 1984, pp402.
[2] HU Xiehe, HU Zhongyi, Journal of Zhejiang University; Special Issue on Electrical Machinery, 1986 pp. 70.
[3] G. Nicolis & I. Prigogine, Exploring Complexity Press FREEMAN, New York 1989.
[4] C. Nicolis & G. Nicolis, Is there a climatic attractor? Nature Vol. 311 No 11, 1984 pp529-532.
[5] A. Babloyantz, et.al. Evidence of the Chaotic Dynamics of Brain Activity During the Sleep Cycle, Phy Lett Vol 111A, No.3 1985 pp 152-156.

The Distance Transcending Effect of External Qi, And Analyzing it Using Laser Raman Observation of Solutions Which Have Physiological Effects

YAN Xin (Chongqing Chinese Medicine Research Institute)
LI Shengping, YU Jianyuan, LI Baihe
(Chemistry Department, Qinghua University)
LU Zuyin
(High Energy Physics Research Institute,
Chinese Academy of Science)

Summary

Using a SPEX1403 Laser Raman Spectroscope, through checking and measuring of such solutions as tap water, physiological saline, glucose solution, naldimeisu solution, etc., all of which have physiological effects upon the qigong masters' release of external or received *qi* in transcending distance (several meters to 1900 Km), it was discovered that the Laser Raman spectrum of the samples of solutions go through changes with the effect of external *qi*.

Scientific experimentation on qigong, especially the scientific experiments conducted by the first-class qigong masters, is different from other scientific experiments. This article provides a detailed explanation on how to design experiments of this kind.

I. Introduction

The practice of qigong and the use of external *qi* to cure sicknesses and the unusual effects it achieves have gradually drawn the interest of scientists.

But everybody is hoping for some breakthrough on such a mysterious and profound subject.

Based on the many years of research on qigong science, we have realized that scientific qigong research experimentation must involve the help and participation of the experienced and seasoned first-class qigong masters, the thinking out and planning of the experiment must be improved, and modern analytical equipment must be used for checking and measuring.

For this purpose, we completed some rather difficult experimentation on solutions, such as tap water, 0.9% physiological saline, 50% glucose solution, a 1.5mg/ml naldimeisu solution and other samples, over which the distance transcending

external *qi* has a physiological effect; we used a laser Raman spectroscope for checking and measuring to observe and determine whether external *qi* affected the samples.

II. The Method and Design of the Experiment

Equipment used for the experiment. In this experiment, the equipment used was a SPEX1403 laser Raman spectroscope. Its main functional indices are as follows:

Resolving power	0.15cm^{-1} (Hg579.1nm)
Raman shift interval	5--4000 cm^{-1}
Wave accuracy	1cm^{-1} (<4000cm^{-1})
Repetition	0.2cm^{-1}

Samples. Tap water, medical 0.9% physiological saline, medical 50% glucose solution, and a 1.5mg/ml maidimeisu solution. The total concentration of Ca^{++}, Mg^{++}, and Na^{++} is 5.7mg/l.

Experiment design. In the past ten years, scientific experimentation and research on qigong had developed rather quickly. From an experimental methodological point of view, these efforts can be put into three categories: (1) Directly applying external *qi* to the detecting head or sensor, in order to discover the its composition and its functional mechanisms. (2) During the release of external *qi* and the circulation of internal *qi*, using various means to measure the change in various physiological parameters and organisms in human and other biological bodies. (3) Directly apply external *qi* to detached organisms (such as cancer cells) and other bacteria, and then using modern analytical method to clearly analyze and study its functional mechanisms.

Now it is clear that the manifestations of qigong's effects are numerous. And the layers of *gongli* (the force or intensity of qigong energy) are rather complex. Under the effect of the external *qi* from first-class qigong masters, the detecting head (sensor) of modern analytical equipment as well as its other parts (exchange, magnification, display) can all be affected, which may lead to false results in the experiment. This is why in a first-class qigong experiment, great care is needed when adopting the original positional (in situ) experimental method.

In past experiments, the functional system of "person--person" or "person--living organisms" is usually adopted, which means the qigong masters release external *qi* to persons, living bodies or living organisms, and it is measured by equipment. This kind of experiment cannot eliminate the psychological effect on the recipient of the external *qi*. In terms of the living organisms, individual as well as environmental differences can

also be factors.

Therefore, it is necessary to design this kind of experiment to completely eliminate the interfering elements from the biological background. The experimental system is actually formed by person--object. That is, the external *qi* released by the qigong masters is done on a lifeless object.

In experiments of this kind, our standard for selecting samples is that their structures must be simple, they are stable under normal circumstances, and they possess certain biological effects.

Because in the body of an adult, the various tissues and the body fluid consists over 65% of water, it is appropriate to select tap water, medical 0.9% physiological saline, medical 50% glucose solution, and a 1.5mg/ml maidimeisu solution, all of which have biological effects. Because tap water, physiological saline, and such solutions are very stable under normal circumstances, we must ask the help of first-class qigong masters in order to have any effect on them. Therefore, in qigong experimentation research, the qigong masters must be involved in the planning and decision of the experiment. At the same time, the *gongli* of qigong masters can be affected by their energy, state of mind, time, environment, and many other complex conditions. Hence, whether the experiment can go on, how qigong is done or when it is done must be decided by the qigong masters. This differs from ordinary scientific research; in experiments of this kind, the qigong master is the main participant. This is exactly the unique characteristics of science research involving the human body.

In addition, in order to confirm the belief that distance-transcending external *qi* can cure sicknesses, we designed an experiment in which the qigong masters do not touch the sample but *fa* the external *qi* from a distance of several meters to dozens of kilometers, with the longest being 1900 kilometers.

Obviously, the degree of difficulty in this type of experiment is extreme. Each time before the experiment, depending on different situations and conditions, the qigong masters must use many different methods for generating qigong energy), as part of preparation, they use *fagong* (the initial stage of qigong, which is the beginning of the generation of energy) and *shougong* (the ending of the generation of energy, the concluding phase). But since the *gongli* of the qigong masters can be affected by their energy, state of mind, environment, and other conditions, in every experiment, the effect of their *fagong* and its force vary. Under such conditions, one should not demand unlimited repetitions of the experiment. However, as long as we

are clear on the background of the experiment, and our analytical method is applied correctly, we can still tell false results from real ones in a limitedly repeated experiment.

The checking and measuring conditions. For those qigong masters who generate great energy, using the original positional method may cause interference in the analytical equipment; therefore, we place samples in a designated lab to receive *fagong* (within the same lab there are other samples for receiving *fagong*). After *fagong*, it is checked and measured on the laser Raman spectroscope. To determine if the equipment is working properly, one must frequently measure the standard sample (the background). In this experiment, the measuring conditions are: the laser spectroscope is an Ar spectroscope, the measuring power is 400mW--500mW, the wave length is 5145 Å, lighting type is 90° and the scanning speed is 0.5s.

Control experiment. In this experiment, all samples are mixed solutions taken from large containers, which will guarantee the consistency of the samples (including the background control and samples). Before each experiment, all the background samples are tested. The results show that all the measuring of the control samples through laser Raman spectroscope is consistent. Fig. 1, 2, 3, and 4 are respectively the control spectrum diagrams of tap water, medical 0.9% physiological saline, medical 50% glucose solution, and 1.5mg/ml maldigrelap solution.

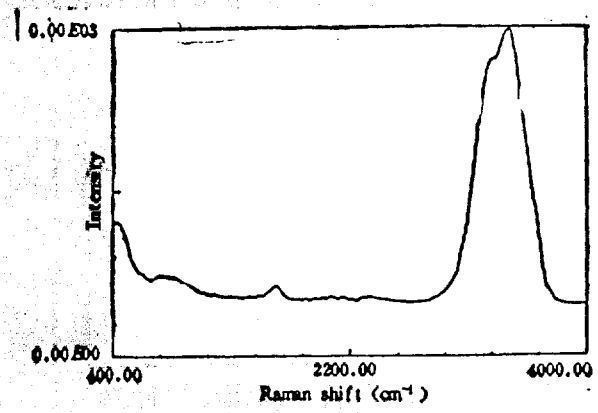


Fig. 1 Raman spectrum diagram of normal tap water

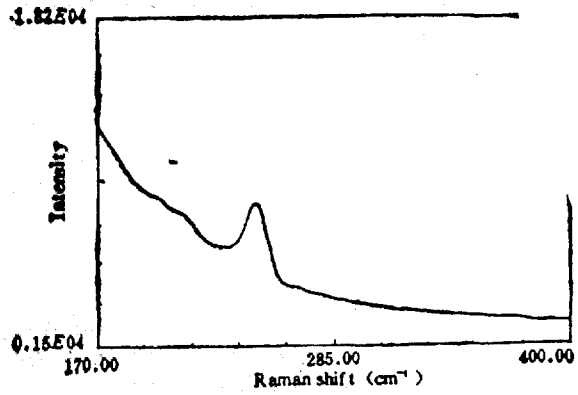


Fig. 2 Raman spectrum diagram of normal medical 0.9% physiological saline

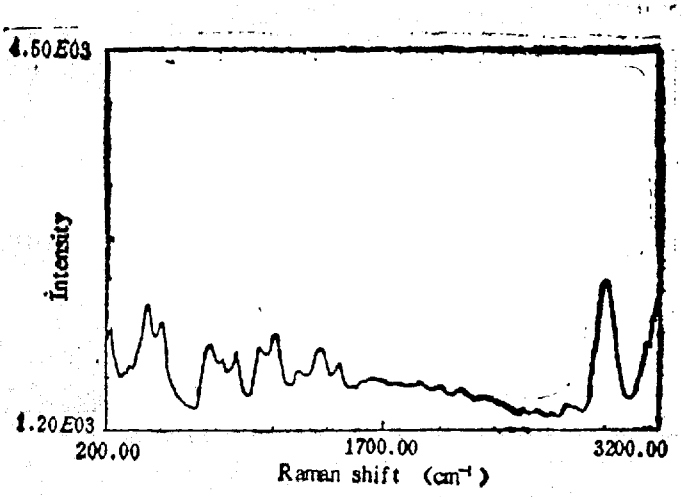


Fig. 3 Raman spectrum diagram of normal medical 50% glucose solution

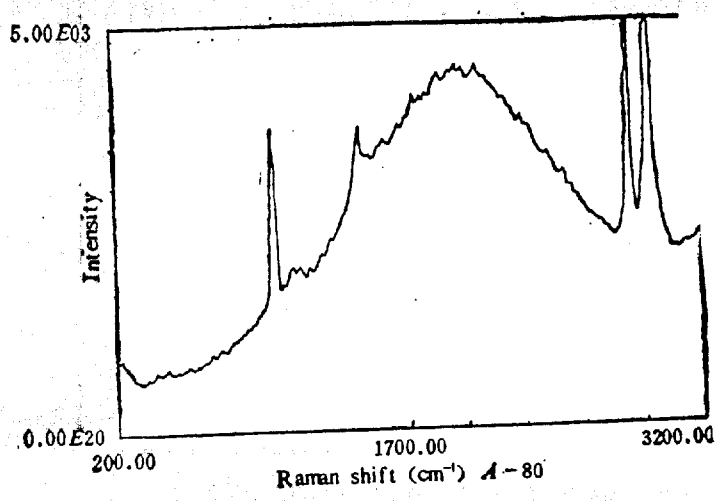


Fig. 4 Raman spectrum diagram of 1.5mg/ml maidimeisu solution

The qigong experimentation method. Before each experiment, the preparation of samples is: use a small glass tube to take out samples from glass containers full with samples; then seal it. Each sample is divided into two groups; each group consists of 2--3 tubes. One group of tubes will be target samples for fagong, and the other group will be kept, untouched by fagong, as control samples. All the sealed samples must be checked and measured to be background. The samples for the experiment must be dispatched into a designated lab, the door of which will be locked, and nobody will be allowed in before fagong. Doctor Yan Xin will be a long distance away, and begin to fagong at the designated time. The fagong distance is 7 kilometers. The duration of fagong is normally under 10 minutes. After fagong, the samples will be transported to the lab containing the laser Raman spectroscope for checking and measuring. The control samples will be kept in the laser Raman lab throughout.

The experiment is done using a double-blind method; that is, the sealing, checking and measuring are all done by the equipment operator; no other person is allowed. Neither is anyone allowed in the laser Raman lab during the checking and measuring. The situation and condition of this group of experiments is listed in Table 1.

Table 1 Conditions of the Experiment

Date	Content	Temper. °C	Method of Communic.	Distance	Result
12/22/95	Tap water	18		3m	Change

12/27/86	Tap water	12	phone	7km	Change
12/31/86	Tap water Glucose solut. Physiol. saline	12		20m	Change
1/5/87	Glucose solut. Physiol. saline	13	phone	7km	Change
1/8/87	Tap water Glucose solut. Physiol. saline	11	phone	7km	Change
1/9/87	Tap water maldinelsu solution	11	phone	7km	Change
1/12/87	Glucose solut. Physiol. saline maldinelsu solution	10	phone	1000km	Change
1/17/87	Glucose solut. Physiol. saline maldinelsu solution	11	phone	1000km	Change
1/20/87	Glucose solut. Physiol. saline maldinelsu solution	11	phone	1000km	Change
1/23/87	Glucose solut.	11	phone	1000km	Change

III. Results and Discussions

Tests on tap water. Over twenty tests on the background of tap water demonstrate that there is an -OH contracting oscillation peak area around 3410cm^{-1} in the laser Raman spectrum diagram, while around 1635cm^{-1}, there is an accompanying -HOH distorted weak oscillation area. But after distance transcending external gi, the laser Raman spectrum diagram of the tap water shows that there is a huge unknown peak within the 1000cm^{-1}--3000cm^{-1} range. The typical result is shown in Fig. 5. In the experiment, on the condition that the analytical condition remains unchanged, we conducted a trace test. The result shows that this peak diminishes and disappears within one hour. The result is shown in Fig. 6. Because test samples and control samples are taken from the same container of tap water, and the background spectrum of the control sample remains normal; hence there is no possibility of contamination causing fluorescence. Moreover, this kind of unknown peak appears numerous times in the

laser Raman spectrum of test samples after they have received external qi, but it never appears in the background spectrum test of the control samples. There is, therefore, sufficient reason to believe that the appearance of this unknown peak is caused by external qi.

Tests on medical 0.9% physiological saline. Under distance transcending external qi, there are some changes in the Raman spectrum of the 0.9% medical physiological saline, in comparison to the normal control spectrum. These changes mostly appear in the shifting of the 240cm^{-1} to 238cm^{-1} of the low wave range between 200--260cm^{-1}. Its typical result is shown in Fig. 7. Because Doctor Yan Xin did *fagong* differently each time, the changes as indicated in Fig. 8 are also noted. Obviously, peak 248cm^{-1} disappears. Of course, like the test on tap water, the spectrum of the control samples remain unchanged throughout. This fact shows that the equipment is functioning normally, and the changes in the laser Raman spectrum of test samples are caused by external qi.

Tests on medical 50% glucose solution. Like the tests on tap water and medical 0.9% physiological saline, after super distance external qi, the Raman spectrum of the glucose solution shows changes in comparison to the spectrum of the control spectrum. Its typical result is shown in Fig. 9. Obviously, in Fig. 9 there is the phenomenon of the disappearance of the 710cm^{-1} peak.

Trace tests on physiological saline and glucose solution show that the Raman spectrum on the samples in the four days of tracing after external qi do not appear to change.

Test on 1.5mg/ml maldimeisu solution. After external qi, the Raman spectrum on the maldimeisu solution, in comparison to the Raman spectrum of the control sample, also shows changes. Likewise, these changes appear in many tests. Its typical result is shown in Fig. 10. Obviously, the 207cm^{-1} peak shifts to 197cm^{-1}. Since the above four solutions are stable under normal room temperature, and we also check to see if the equipment functions properly by checking the control samples before and after the test, and randomly check the samples during the test; therefore, we can definitely determine whether the laser Raman spectrum on the external qi samples shows any changes over the laser Raman spectrum of the control samples that do not receive external qi.

The tests show, under the distance transcending effects of external qi of Doctor Yan Xin, changes of varying degree occur in the Raman spectrum for the four sample solutions of physiological characteristics used in the experiment. This fact shows that

external *qi* has affected the structure of these solutions to a certain extent. Therefore, this experiment also reminds people that one of the ways qigong masters cure sicknesses in people with external *qi* is through the effect of external *qi* on the fluids and tissues in human bodies, causing a certain degree of structural and functional change, thereby achieving the effect of cure through physiological adjustment. Therefore, development of this kind of experimental research is of significance.

Of course, this work only uses a Laser Raman unit to measure and confirm the effects of external *qi* used by a qigong master on several solutions having physiological effects. The work is still in an early stage. But in order to for deeply probe the mechanism of the biological effects produced by external *qi* on matter, especially the mechanism of distance transcending external *qi*, in the future it will be necessary to conduct much further in-depth research.

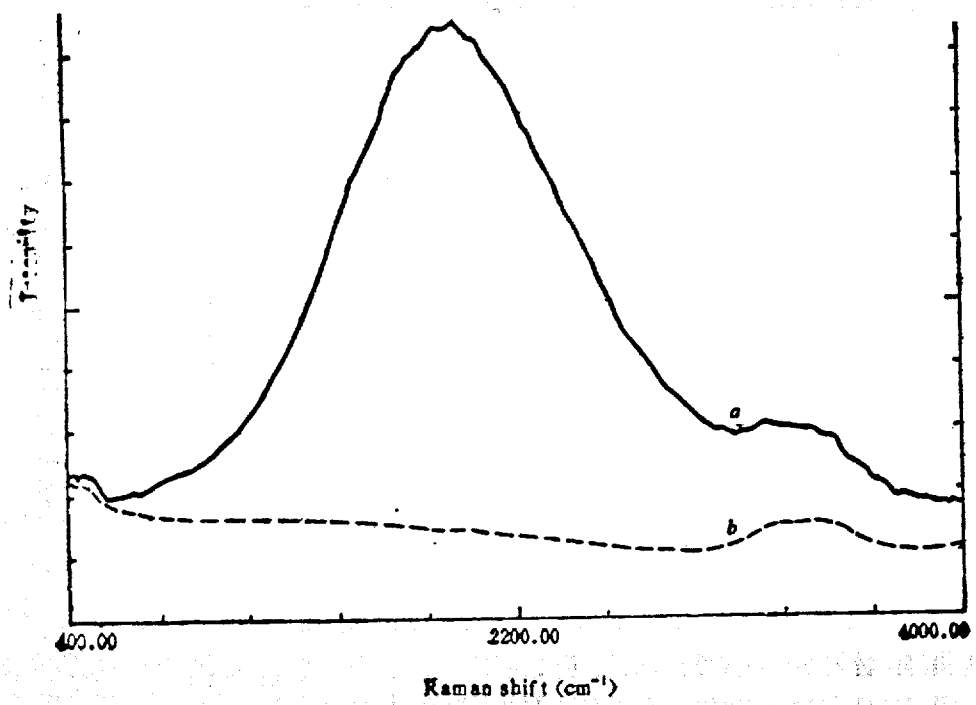


Fig. 5 Raman spectrum Fig. of tap water after external qi

a--0.5 hour after qigong b--tap water background before

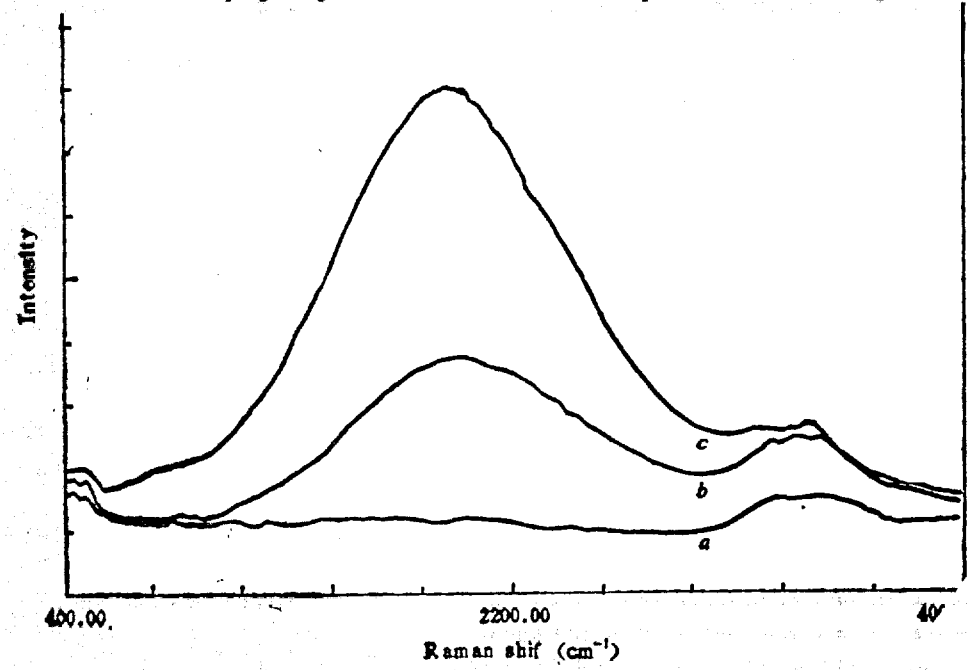


Fig. 6 Raman spectrum trace Fig. of tap water after qigong.

c--0.5 hour after external qi
b--1.5 hour after qigong (7km super distance)
a--0 hours after qigong.

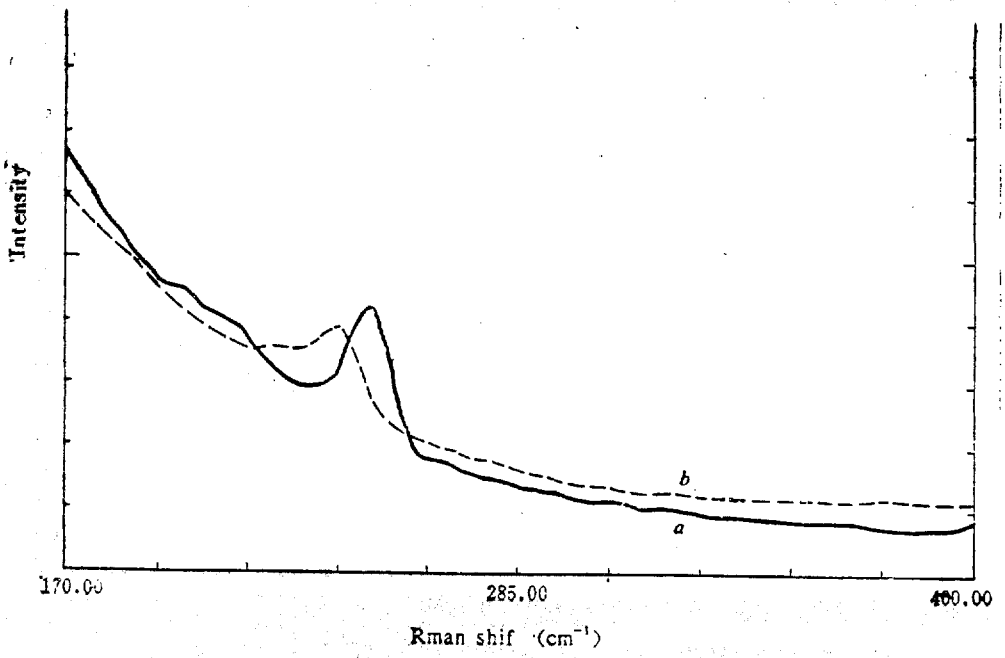


Fig. 7 Raman spectrum diagram of medical 0.9% physiological saline solution.

a--Raman spectrum before external qi (7km distance)
b Raman spectrum after external qi

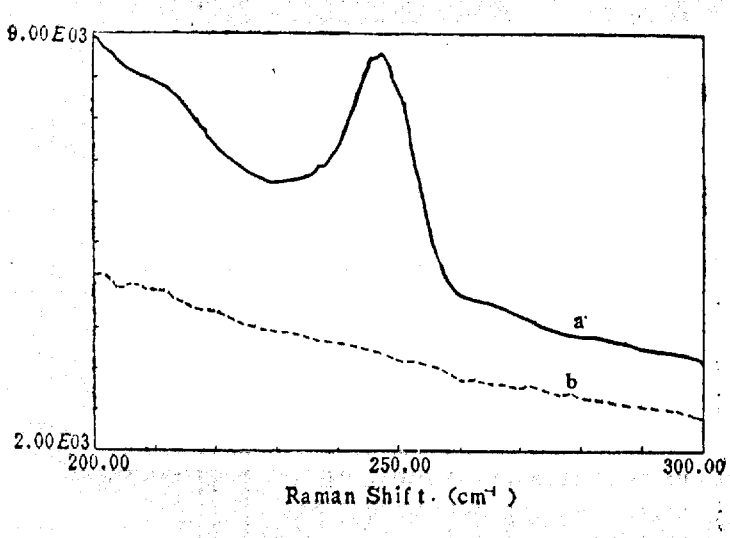


Fig. 8 Raman spectrum of medical 0.9 physiological saline

a--Raman spectrum before external qi
b--Raman spectrum after external qi

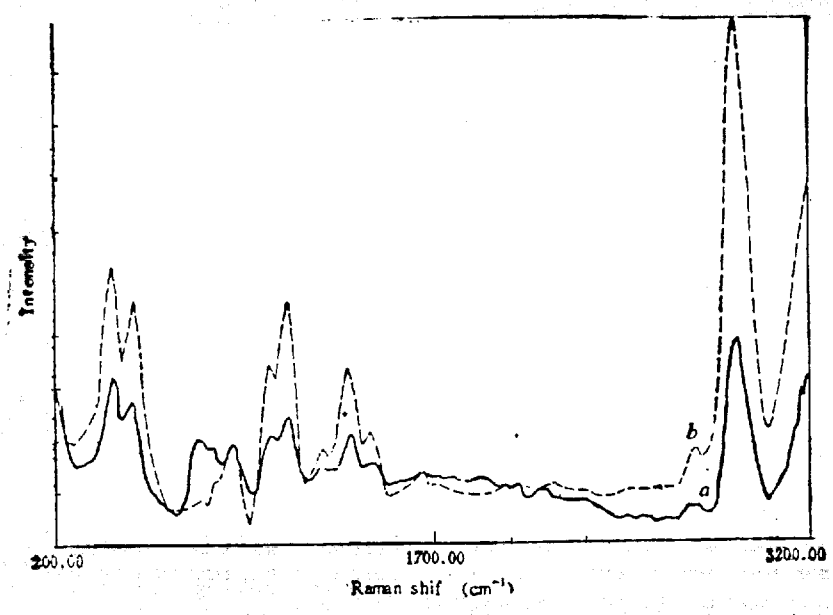


Fig. 9 Raman spectrum diagram of medical 5% glucose solution

a--Raman spectrum before external qi
b--Raman spectrum after external qi

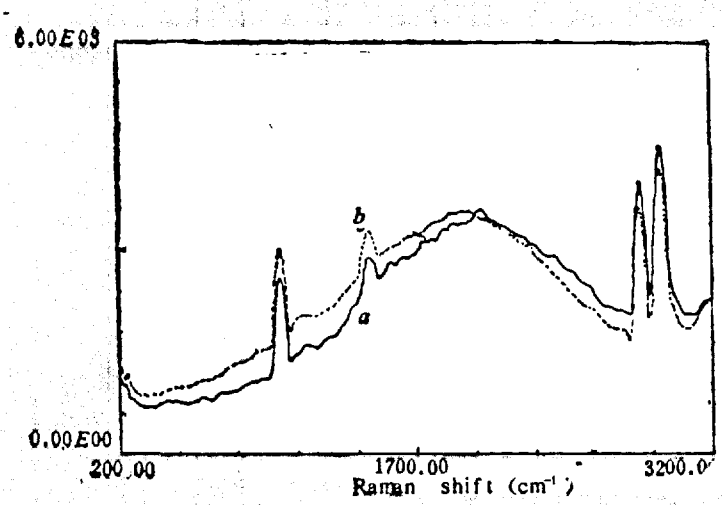


Fig. 10 Raman spectrum of 1.5mg/ml maidimeisu solution

a--Raman spectrum before external qi
b--Raman spectrum after external qi